ciated; and unfortunately the days cannot be very far distant when economy in fuel will become even more necessary than it is now.

Siemens, as is well known, had greatly at heart the subject of smoke abatement. He applied his principles to the construction of domestic fires, which are the main causes of smoke and fog in many of our large towns. His improvements have not yet to any considerable extent been adopted, but it is greatly to be desired that a reform in this direction should speedily be brought about.

To describe his labours in connection with the introduction of the electric light, the electric furnace, electric transmission of power, electric propulsion on railways, would be quite beyond our limits. We can only refer our readers to Mr. Pole's account of these subjects. The necessary explanations are given with admirable clearness, difficult as it is to compress them into moderate limits; and the book, in spite of our strictures at the commencement of this notice, will be found full of instruction and interest.

SOME PALÆOZOIC DIPNOAN FISHES.

Fauna der Gaskohle und der Kalksteine der Permformation Böhmens. Band II. Heft 3, Die Lurchfische, Dipnoi, nebst Bemerkungen über silurische und devonische Lurchfische. Pp. 65–92, Pls. 71–80. Von Anton Fritsch. (Prag: in Commission bei Fr. Řivnáč, 1888.)

ANOTHER part of Dr. Anton Fritsch's well-known work upon the Vertebrate fauna of the Permian rocks of Bohemia has lately appeared, and the description of the fishes is thus commenced. The nature of the subject does not admit of the introduction of so many novelties as characterized some of the previous parts; but the interest and value of the work is fully sustained, and the discussion of the characters of *Ctenodus*—the only known Dipnoan fish of the Bohemian Gas-coal—is supplemented by some remarks upon a few of its Palæozoic allies, with special reference to the supposed evidence of Dipnoans from the Upper Silurian of Bohemia. In addition to the ten beautifully-executed plates, the text is accompanied by numerous woodcuts, and no less than ten of these represent illustrative fossils that are not Bohemian, while six are devoted to important features in the skeletal anatomy of the living *Ceratodus.*

Dr. Fritsch commences by emphasizing the intimate relationship existing between the genera *Ctenodus* and *Ceratodus;* and each portion of the skeleton of the Permian fish, so far as determinable, is then compared in detail with the corresponding element in the existing genus. The fossils, unfortunately, are for the most part fragmentary, almost all the head-bones being scattered, and none of the bones of the trunk and fins being discovered in natural series; but many can be identified with considerable certainty when rigorously compared according to the author's method.

In the skull of *Ctenodus* there are several ossifications in parts that remain permanently cartilaginous in *Ceratodus*, and the dermal roof-bones are much more numerous than in the last-named genus. A bone that was formerly described as the pelvis of a Stegocephalian is now recognized as the squamosal of *Ctenodus.* There is no certain evidence of maxillæ and premaxillæ; and the mandible exhibits possibly another feature of close agreement with *Ceratodus* in the small size and scale-like character of the bone named dentary by Huxley. Dr. Fritsch considers that the latter element is too insignificant to represent the dentary, and may thus be more appropriately termed "dermomental"; but his argument appears to us far from satisfactory.

An interesting point is remarked upon in connection with the dentition of *Ctenodus.* The commonest of the two species recognized at Kounová was originally founded upon the evidence of detached teeth, and named *Ceratodus barrandei*, Fritsch; but it is now identified with the well-known English Coal-Measure species, *C. obliquus*, Hancock and Atthey. The teeth vary so much in size and so little in characters that Dr. Fritsch represents a series to illustrate several stages in the life-history of the fish; and the small teeth named *C. elegans*, Hancock and Atthey, thus appear to pertain merely to young individuals of *C. obliquus.*

Proceeding to a discussion of the axial skeleton of the trunk, Dr. Fritsch finds evidence of the persistence of the notochord, with the same arrangement of the neural and hæmal arches as is met with in *Ceratodus.* In regard to the parts of the appendicular skeleton, however, satisfactory comparisons are as yet impossible; though it is considered likely that, in the pectoral arch, *Ctenodus* exhibited a greater number of distinct elements than the existing genus.

The scales of *Ctenodus* are large, thin, and round, and the outer surface of each "appears smooth in the middle, and is only seen to be rugose when highly magnified. The border exhibits concentric lines of growth, of varying width, parallel to the margin. Across these extend small parallel ridges, on the middle of which are rows of minute pits, apparently indicating the spots that originally supported denticles." Another noteworthy feature is the forked appearance of the sensory canal upon a detached scale of the lateral line—a condition unknown in *Ceratodus.*

As the result of his researches, Dr. Fritsch concludes that the Bohemian examples of *Ctenodus obliquus* must have attained a length of about 140 centimetres. In every part of the skeleton there is evidence of more complete ossification than is observable in the existing *Ceratodus;* and the occurrence of a greater number of dermal roof-bones in the skull of *Ctenodus* as compared with that of the living Dipnoan is a parallel case to that of the Amphibia previously discussed,—the Permian groups having the skull better armoured than their allies at present existing.

After defining the teeth of a new species (*C. applanatus*) from the Gas-coal of Kounová, and having also briefly noticed another form (*C. trachylepis*) known only by three scales from Nyřan, Dr. Fritsch proceeds, in conclusion, to treat of some of the remains of Dipnoan fishes met with in the Devonian and Silurian, mostly of the Continent. A new genus and species, *Dipnoites perneri*, is indicated by a supposed head-bone from the Upper Silurian of the neighbourhood of Prague. A new and more satisfactory figure of the type-specimen of *Gompholepis panderi*, Barrande, is next given; and this, too, is regarded as

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a dermal bone of the cranial roof of a Dipnoan, an interesting bone of *Ctenodus* being figured for comparison. The Old Red Sandstone fossil, named *Phyllolepis concentricus* by Agassiz, is also interpreted as probably the head-bone of a closely-allied fish; and the remarkable skull-fragment known as *Archæonectes pertusus*, H. von Meyer, is considered to be the bony portion of the palate, wanting the teeth.

To the appended synopsis of the literature of the subject, we might add two important papers on *Ctenodus*, by W. J. Barkas, published in the Proceedings of the Royal Society of New South Wales, 1876–77; and the list of known Palæozoic Dipnoan fishes must be reduced by one (*Strigilina*), which is founded upon a tooth of a Selachian. We would also remark that the so-called *Campylopleuron* is almost certainly founded upon the tail of *Ctenodus*, as pointed out by Dr. Traquair (NATURE, vol. xviii. p. 483). In every respect, however, the memoir affords evidence of the most elaborate and painstaking research; and it must long remain a standard work of reference for all who are interested in the palæontology of the Dipnoan fishes.

A. S. W.

OUR BOOK SHELF.

A Revision of the Heterocyst Nostocaceæ. By Ed. Bornet and Ch. Flahault. (Separate reprint with index.) (Paris, 1886–88.)

IN this very important contribution to our knowledge of this interesting group of Algæ, the publication of which commenced in the third volume of the *Annales des Sciences Naturelles*, vii. série (1886), and was concluded in the seventh volume, published this year (1888), we have a work of great labour and research, upon the happy completion of which the authors are to be congratulated.

Those who have investigated the forms of these Algæ will remember the extreme difficulties they have experienced in determining the so-called species of many of the authors whose works they were obliged to consult. Too often it has happened that, unable to recognize a form collected, it has been described as new, and so but added to the big pile of synonyms.

Accepting the division of the hormogonous Nostocs into the two subdivisions of those with "uniform cells" and those with "dissimilar cells," it is with the latter group that the present "Revision" has to do. For many years the authors have investigated all the examples, living or dried, that they could procure. The herbaria of Brébisson, Chauvin, Grunow, Lenormand, Thuret, and the collections of the Museum of Paris, have all been consulted, with the result that an immense mass of described species have been treated as synonyms; while a certain number, of which type-specimens were not to be had, or on account of difficulties of referring them to known genera, have been enumerated as "species inquirendæ."

Introductory to the description of the genera and species we have an account, up to the present state of our knowledge, of the vegetative cells, the filaments, and the trichomes, the outer envelope (cytioderm), the heterocysts, the ramification, the hormogonia, and the spores. Of these two latter modes of reproduction, that by the "hormogones" has been the longest known, and is the one to be found in most of the genera; while that by "spores," destined to preserve the species during the intervals of vegetation, and enabling it to resist desiccation, is known only to occur in some few of the genera, but the authors add "that it is permissible to think that it will soon be known to occur in all." These spores are easily distinguished by their size, their more rounded form, and their more marked granular contents. They often possess a brownish-yellow epispore; in some instances they have been proved to retain their vitality for a considerable time; the spores of *Cylindrospermum licheniforme*, Kutzing, have germinated after a nine years' sojourn in a dried state, in an herbarium. About their behaviour just at the period of germination we have still something to learn. The "conidia" of Borzi are also alluded to. A conspectus of the genera of each of the four tribes of the sub-family is given; the four tribes recognized being the Rivulariaceæ, Sirosiphoniaceæ, Scytonemaceæ, and Nostocaceæ. After the list of genera comes the list of species, with analytical keys and detailed diagnosis of each. There is a very full account of the geographical distribution of all the species.

In a notice the main object of which is to call the attention of our readers interested in these for the most part fresh-water Algæ, it would not be proper to enter into minute details, so we will content ourselves with a statement of our belief that this memoir of Dr. E. Bornet and M. Flahault will not only do very much to assist the botanist, but will also go far to awaken a new interest in a group of plants in which there is abundant field for further research.

E. P. W.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Mr. Spottiswoode's Mathematical Papers.

AT the request of Mrs. Spottiswoode, I have undertaken to edit these papers. Mrs. Spottiswoode has kindly looked over her collection, and put into my hands author's copies of such papers as she has. I still lack the following, which some one or more of the late President's friends may perhaps be able to lend me. The numbers are those of the Royal Society's Catalogue.

I. *Phil. Mag.*, xxxvi. (1850); VI. *Crelle*, xlii. pp. 169–78; VIII. Tortolini, *Annali*, iii. (1852); IX., X. *Camb. and Dub. M. Journ.*, viii. (1853); XIII. R.S. Proc., vii. (1854); XX., XXI. same, xi. (1860); XXII. [as regards Geog. Soc. Proc., v. (1861)]; XXIV. Brit. Assoc. Report (1861); XXV. *Crelle*, lix. (1861); XXXIII. [as regards *Quart. Journ.*, vi. 1864]; XXXVII., XXXVIII., *Quart. Journ.*, vii. (1866); XLVIII., XLIX., and some other papers in the *Comptes rendus* (1874–76). I am especially anxious to receive the *first* part of the "Meditationes Analyticæ," of which we have not found a complete set. *All* the papers are in Mrs. Spottiswoode's library, she believes; but I am anxious to preserve these if possible from passing into the printers' hands.

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Statistics of the British Association.

IT is to be feared that the "ladies' curve" in the diagram (NATURE, December 13, p. 153) fails to give anything like accurate information respecting the number of ladies at the meetings of the British Association. Omitting foreigners, the attendance is made up of "members," "associates," and "ladies," but, as a matter of fact, a large number of ladies are members or associates, while only the remainder take "ladies' tickets,"—that is, tickets transferable to ladies, the only transferable tickets issued by the Association.

The column headed "Ladies," in the table (see the Association's Report for 1887, pp. lv.–lvi.) states that 493 ladies attended the last Manchester meeting; but that merely shows that 493 of the ladies who were present took "ladies' tickets," and does not include the lady members and lady associates who were at that meeting. During its meetings the Association publishes lists of the members and associates who are present, exclusive of the holders of "ladies' tickets." By going over the Manchester lists it will be found that upwards of 700 ladies who were either members or associates were in attendance; so that,

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